SIX DOLLARS

A CAHNERS PUBLICATION

Electronic Business

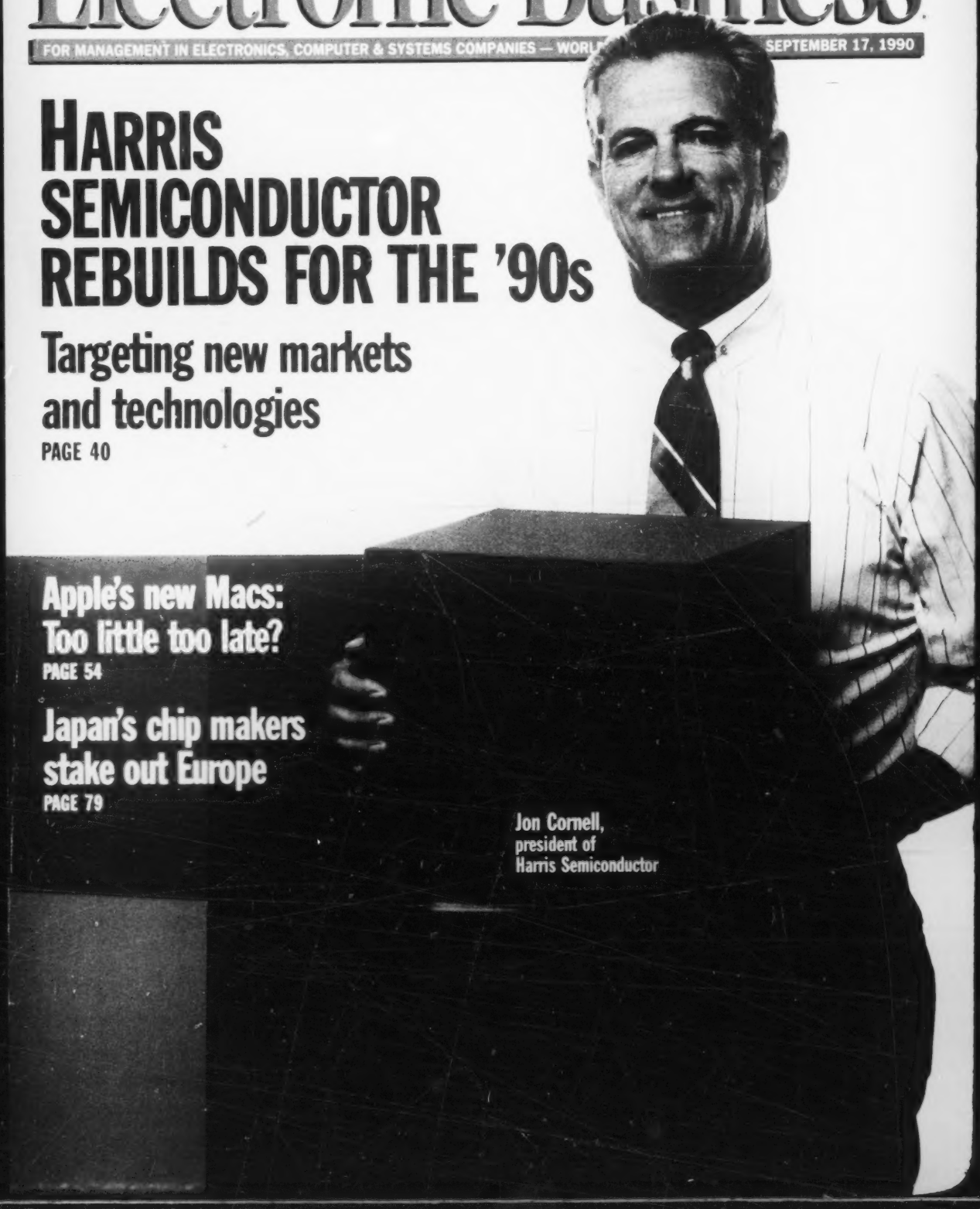
FOR MANAGEMENT IN ELECTRONICS, COMPUTER & SYSTEMS COMPANIES — WORL

SEPTEMBER 17, 1990

HARRIS SEMICONDUCTOR REBUILDS FOR THE '90s

Targeting new markets and technologies

PAGE 40



Apple's new Macs: Too little too late?

PAGE 54

Japan's chip makers stake out Europe

PAGE 79

Jon Cornell, president of Harris Semiconductor

Electronic Business

FOR MANAGEMENT IN ELECTRONICS, COMPUTER AND SYSTEMS COMPANIES — WORLDWIDE

VOL. 16, NO. 18

SEPTEMBER 17, 1990

Cover: Mike Collins

PAGE 40 Harris Semiconductor CEO Jon E. Cornell: Determined to avoid others' mistakes, he made his own instead

COVER STORY/HARRIS SEMICONDUCTOR

40 Building the new Harris

Two years into its strategic acquisition of General Electric Co.'s Solid State Division, Harris Semiconductor has more than doubled in size and has managed to shield itself from cuts in defense spending. Fitting together the pieces of the "new" Harris was far from easy.

UPDATE

13 Business Trends
Electronics industry feels effect of venture-capital slump; Sun lines up resellers; Sony taps the EDA market, due to hit $2.24 billion; Conner investors cash in on success; U.S. company finds Soviets hungry for CAD; SEMI urges decontrol of equipment exports; Nynex invests $100 million in hand-held network; Qume CEO banks on Asia telecom expansion.

27 Economic Trends
U.S. behind the curve as Japan now outspends Uncle Sam on capital equipment; a shortage of skilled U.S. labor looms.

29 Companies to watch
Expert Views eases choice of PCB components; Ascend Communications makes ISDN connections; Peer's computer manages complex networks.

33 Commentary
New opportunities open as software finally drives hardware sales. Microsoft's Windows 3.0 was the product introduction of the decade — the 1990s, that is.

UPDATE

35 Letter from India
The eight-month-old government [illegible] has introduced long-awaited [illegible] that promise a bright future for [illegible] high-tech investment.

HARRIS SEMICONDUCTOR

40 Building the new Harris
A strategic acquisition can give a company an entirely new look, complete with new markets, practically overnight. But making the pieces fit together harmoniously is a long-term chore, as Harris Semiconductor found out.

42 Harris builds a working model for high-tech partnering
With its profitable investment in Cadence Design Systems Inc., Harris Semiconductor built a prototype for successful high-tech partnerships. And Harris continues to pick winners from the ranks of start-up companies.

STRATEGIES

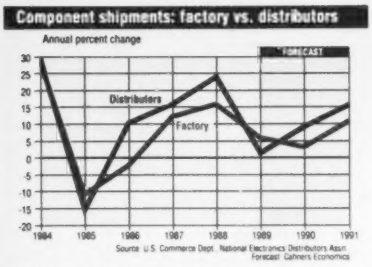
49 Racal-Redac races to broaden its niche
Even with technological superiority and a well-heeled parent company, Racal-Redac Group Ltd. is racing the competitive clock as it transforms itself from a leader in the PCB-CAD niche into a full-line supplier of EDA products.

54 Can Apple polish up its marketing act?
Apple Computer Inc. is launching a new family of low-cost Macintoshes to recover the market share it lost when it deserted the low end of the personal-computer market in the late 1980s. Analysts doubt that Apple's machines or its marketing are up to the job.

MANAGING RESOURCES

63 In the throes of change: Europe's top companies
As Europe races toward unity, it will be the Continent's leading electronics companies that set the pace for industrial growth in the post-cold-war era. ELECTRONIC BUSINESS lists the top 50 European companies and all their vital statistics.

PAGE 29 Expert Views' Leslie Swanson: Simplifying the choice of components



PAGE 117 Component upturn expected

PAGE 54 What Apple Computer needs is some aggressive marketing, say analysts

PAGE 69 Lotus Development's Brownell Chalstrom: "Today's communication technologies don't meet business needs"

PAGE 13 Nynex caters to Big Apple's users of hand-held telephones

MANAGING RESOURCES

69 Groupware: Cashing in on networked computing

Electronic mail was just the beginning. Forecasters say the corporate world, obsessed with productivity, will pay handsomely for software that will let hundreds of employees interact effectively over long-distances.

EUROPE BUSINESS

79 Japanese chip companies beef up European design and research

There's more than one way to capture a continent. Japanese semiconductor companies, whose screwdriver assembly plants ran afoul of European Community sanctions a decade ago, now are investing heavily in design and product development in Europe. The new wave of investment has U.S. and European companies worried.

ASIA/PACIFIC BUSINESS

87 Taiwan's new chip makers struggle for survival

Fabrication plants are springing up all over Taiwan as the island's semiconductor industry experiences heady growth. But overcapacity may collide head-on with slowing global demand unless industry leaders do some serious strategic planning.

MARKET PERSPECTIVES

97 Contract manufacturing: fast growth, low margins

Equipment makers are turning more and more to contract manufacturers for today's sophisticated assembly techniques. Meanwhile, the cost of that technology has contractors skating on the thinnest of profit margins.

100 Contract manufacturing directory

A listing of manufacturers: who they are, how to reach them and what they offer, from the industry leaders to the under-$1 million companies.

BUSINESS BAROMETER

117 **Components**

Improving shipments, orders, backlogs and inventories lead Cahners Economics to forecast an electronic components upturn.

118 **Distributor orders**

Although major electronics distributors report slowing growth in orders, the underlying business trend is up.

DEPARTMENTS

5 **Inside Business**
9 **Letters**
113 **My View**
Great idea: the brand czar
114 **Advertiser index**
120 **Viewpoint**
Computer playing field sees new lineup

COMPANIES IN THIS ISSUE

110 An index of the companies covered in this issue.

EDITORIAL STAFF

Publisher: Frank J. Burge

Editor: Jeffrey Bairstow

Managing Editors: H. Garrett DeYoung, Bruce C.P. Rayner

Senior Editors: Linda Stallmann (Financial), Rick Whiting, Barbara N. Berkman, Teri Sprackland

Associate Editor: Peter L. Burrows

Assistant Editors: Barbara Jorgensen, Xiong Xiaoge, Giuseppe Labianca

Section Editor: John W. Parker

Contributing Editors: Elizabeth Baatz (Cahners Economics), Dwight B. Davis (Seattle), Madeline Franchi (Cahners Economics), Sarah Glazer (Boston), Charles L. Cohen (Tokyo), Julie Handelman (Cahners Economics), Nancy Rutter (San Francisco), Linda Bernier (Brussels), Paula Doe (Seattle)

Consulting Editors: Alberto Socolovsky, Allen Furst

Senior Production Editor: Karen J. Covey

Assistant Production Editor: Maura A. Baker

Editorial Assistant: Jean O'Brien

ART STAFF

Art Director: Michael Roach

Associate Art Director: Carla Aguilar Leeder

Staff Artist: Michele G. Kane

EDITORIAL OFFICES

Boston: Cahners Building
275 Washington Street, Newton, Mass. 02158
(617) 964-3030 Telex: 94 0573 CPC BSN
Fax: (617) 558-4327 MCI: EBBOS

Washington, D.C.: Pam Nazaruk
1333 F Street, N.W., Suite 720
Washington, D.C. 20004 (703) 960-4549

San Jose, Calif.: Teri Sprackland
Sherman Building, 3031 Tisch Way, Suite 100,
San Jose, Calif. 95128 (408) 296-0868

Northwest: Dwight B. Davis
2924 Queen Anne Ave., N.
Seattle, Wash. 98109 (206) 284-5130

London: Barbara N. Berkman
27 Paul Street
London EC2A4JU England 011-44-71-628-7030
Fax: 011-44-71-628-5984

PRODUCTION

VP Production: Wayne Hulitzky

Director of Production/Manufacturing: John R. Sanders

Production Supervisor: Andrew A. Jantz

Production Manager: Betsy Harkins; (617) 964-3030

CIRCULATION

Circulation Manager: Ann Ward
44 Cook Street, Denver, Colo. 80206
(303) 388-4511

Total Circulation: 77,804

REPRINTS

ELECTRONIC BUSINESS articles are available on a custom printing basis at reasonable prices. Contact Andrea Marwitz, Cahners Reprint Service, Cahners Plaza, 1350 E. Touhy Ave., P.O. Box 5080, Des Plaines, Ill. 60018 (708) 635-8800
Electronic Business can be purchased on 35mm microfilm through University Microfilm Int. Periodical Entry Dept., 300 Zeeb Road, Ann Arbor, Mich. 48106

Acquisitions: A high-speed tire change

The phrase "strategic acquisition" always sounds impossibly neat and precise. Wouldn't you like to know what really goes on in these high-powered, high-stakes deals? In our cover story, San Jose-based Senior Editor Teri Sprackland provides a rare inside look as she chronicles Harris Semiconductor's acquisition of General Electric Co.'s Solid State division.

Xiong Xiaoge, Assitant editor

"Like changing a tire at 160 miles an hour," was how one Harris executive described the acquisition process. Four separate operations around the world had to be integrated into Harris Semiconductor. There were differences in corporate culture, massive administrative adjustments and crucial issues of product strategy to resolve. In the end, Harris Semiconductor itself virtually became a new company.

Companies like Harris manage to put it all together; other companies, like Apple Computer Inc., often seem to come unglued. The computer industry has been waiting for Apple to reinvigorate the low end of its product line, and next month the company will try to oblige by introducing three new low-priced Macintosh computers. How good are the new computers, and how skillfully will Apple market them? Contributing editor Nancy Rutter took those and other questions to leading industry analysts. The answers aren't encouraging.

The experts say Apple needs both snappy new products and effective marketing and distribution, and on both counts the company falls short. Even worse, according to experts, Apple seems to have installed a perpetually revolving door on its executive suite, just when it most needs stable management to effectively push its new products.

Here at ELECTRONIC BUSINESS, we're constantly rolling out our own new editorial products, and among the most challenging to produce are the company directories that accompany our Market Perspective and Managing Resources features. Assistant editor Xiong Xiaoge did much of the work for this issue's directory of contract manufacturers, as he has for other recent directories and for many surveys. Hunan-born Xiaoge also is a frequent contributor to our Asia Business and Business Trends sections.

The directory-building process starts months before publication when survey forms are mailed to companies in the particular market of interest. Once all the responses are collected, the companies are telephoned if follow-up information is needed. Xiaoge logs hundreds of calls to track down even the most elusive company presidents and CEOs. Like any good journalist, Xiaoge has to be part detective.

JOHN W. PARKER, section editor

ELECTRONIC BUSINESS® (ISSN 0163-6197) is published twice a month, except monthly in December, by The Cahners Publishing Company, A Division of Reed Publishing USA, 275 Washington Street, Newton, MA 02158-1630. Terrence M. McDermott, President; Frank Sibley, Senior Vice President/General Manager, Boston Division; Jerry D. Neth, Senior Vice President/Publishing Operations; J.J. Walsh, Senior Vice President/Finance; Thomas J. Dellamaria, Senior Vice President/Production and Manufacturing; Ralph Knupp, Vice President/Human Resources. Circulation records are maintained at Cahners Publishing Company, 44 Cook Street, Denver, CO 80206-5800. Telephone: (303)388-4511. Second-class postage paid at Denver, CO 80206-5800 and additional mailing offices. POSTMASTER: Send address corrections to ELECTRONIC BUSINESS®, PO Box 173377, Denver, CO 80217-3377. ELECTRONIC BUSINESS® copyright 1990 by Reed Publishing USA; Ronald G. Segel, Chairman and Chief Executive Officer; Robert L. Krakoff, President and Chief Operating Officer; William M. Platt, Senior Vice President. Annual subscription rates for non-qualified people: USA, $79.95; Canada, C $99.95; other countries, $120 per year; $100, air mail surcharge. Except for special issues where price changes are indicated, single copies of regular issues are available for $10.00 (USA, Canada/Mexico and foreign). Please address all subscription mail to Eric Schmierer, 44 Cook Street, Denver, CO 80206-5800. Cahners Publishing Company, A Division of Reed Publishing USA • Specialized Business Magazines for Building & Construction • Research • Technology • Electronics • Computing • Printing • Publishing • Health Care • Foodservice • Packaging • Environmental Engineering • Manufacturing • Entertainment • Home Furnishings • Interior Design. Specialized Consumer Magazines for Child Care • Boating • Wedding Planning.

VBPA ABP

VENTURE CAPITAL

Industry will feel effects of slump in venture-capital market

PITY THE VENTURE capitalists. Last year was bleak, and this year looks just as bad. For the U.S. electronics industry, that ultimately means fewer startups and maybe less activity overall.

Recently released data from Venture Economics Inc., Needham, Mass., shows venture-capital disbursements have been falling for three years running. Total capital disbursed was down last year by 10.7% to $3.3 billion. The money was distributed to a total of 1,355 businesses, down from 1,472 in 1988. In all, there were only 1,693 financing rounds last year, a decline of 83 from 1988.

In the electronics sector, disbursements were down in all areas except software and services. Hardware, once the darling of the venture community, dropped to fifth place in terms of capital invested.

The story is just as bad on the credit side of the ledger. Money raised by independent private venture funds was down 19% in 1989 after a precipitous drop in 1988 of 30%. Only $2.4 billion was raised last year, down from a record $4.2 billion in 1987.

More serious for the long term was the withdrawal from the market of 54 venture investors last year. Only 772 venture capital firms were active last year, down from a high of 853 in 1986.

The leveraged buyout fell into disfavor in 1989 among venture capitalists. The amount of money plowed into LBOs dropped by 31% last year to $674 million. Why? Partly because of unrealistically high valuations, high interest rates and tight credit.

On the bright side, seed investments are up. The amount of seed funding shot up by 40% while the number of companies receiving the money rose by only 7%. Reason: Seeding is getting more expensive.

What's in store for 1990? More of the same, predicts Steven Galante, a Venture Economics vice president. In disbursements, he anticipates a leveling-off or a slight decline. "There is still a lot of capital that has to get put to work," he says.

As for attracting capital, Galante forecasts a 3% decline to about $2.2 billion in 1990. The first half of 1990 saw a 10.5% decline from the same period in 1989, so in actuality the second half is expected to be upbeat.

And for electronics? A continued fall from grace is expected as the computer market matures. Galante expects to see more follow-on investments in the hardware sector, with the possibility of renewed interest in startup activity in a few years. Software and service-related investments — those investments that add value to under-used hardware and are generally cheaper to seed — will continue to see some growth.

Galante remains an optimist. "That contraction [in disbursements] is one of the best things happening in the industry," he wrote in a recent special report. "It is forcing venture capitalists to invest more cautiously."

BRUCE C.P. RAYNER

Ranking of venture-capital activity

(Ranked according to 1989 capital invested)

	Capital invested ($ millions)		Number of companies	
Industry	**1988**	**1989**	**1988**	**1989**
Medical/Health care	429	469	197	198
Other products/services	735	468	159	149
Consumer-related	426	370	181	144
Software and services	340	358	198	204
Computer hardware	417	342	186	158
Telecomm and datacomm	369	336	142	123
Other electronics	287	267	123	114
Biotechnology	311	250	110	97
Industrial products	189	197	97	95
Commercial communications	154	107	39	40
Industrial automation	29	33	27	21
Energy related	15	17	13	12
Total	**3,701**	**3,214**	**1,472**	**1,355**

Source: Venture Economics

WORKSTATIONS

Sun signs agreements with major resellers

AFTER PONDERING for months what president and chief executive officer Scott McNealy called a $1 trillion question, Sun Microsystems Inc. has launched itself into the dealer channel by signing distribution agreements with three major reseller organizations. The Mountain View, Calif., workstation company thinks it can keep control by setting service and value-added requirements for the estimated 200 dealers expected to participate in the program.

In July, Sun unveiled distribution pacts with Intelligent Electronics in Exton, Pa.; MicroAge Inc. in Tempe, Ariz.; and Nynex Business Information Systems Co. in White Plains, N.Y. Each will resell Sun workstations through local computer centers throughout the U.S., MicroAge and Nynex through their own outlets and Intelligent Electronics through selected Entre, Connecting Point and Today's Computers Business Centers franchises.

Although Sun already has value-added-reseller (VAR) agreements with close to 50 reseller outlets, the new deals mark the first time that Sun has signed national agreements with franchise organizations. But dealers will be required to add value to the workstations they sell in the form of software, training and support. Sun has also reserved the right to approve each individual reseller.

Sun managers say the new deals establish an infrastructure for the

EDA

Sony using EDA to sell workstations

IN A RENEWED effort to infiltrate the U.S. workstation market, Sony Microsystems Co. has identified the worldwide $2-billion electronic-design-automation (EDA) market as a good place to start.

The San Jose-based company, a subsidiary of $16-billion Sony Corp., is now actively courting EDA vendors eager to be ported to Sony's NEWS workstation, which has captured 20% of the Japanese market since being introduced in January 1987, according to market researcher Dataquest. Among the vendors already signed on are Cadence Design Systems Inc., Racal-Redac Group Ltd., Synopsys Inc. and Valid Logic Systems Inc.

"EDA kind of found us," says Sony product manager Athol Foden. "First of all, there is such internal demand for EDA at Sony that the major vendors have ported to us because they want our business. The second reason is that we're so successful in Japan, which is the fastest-growing market for EDA."

Sony has been unsuccessful in selling NEWS in the U.S. for the past two years, but observers say things could change. As of December, the company is offering machines based on reduced-instruction-set computing and boasting price performance of $400 per million-instructions-per-second, the company claims — a step better than the new industry benchmark, the $472 per MIPS offered by the IBM RS/6000.

Does this represent a real threat to the U.S. workstation market? "NEC put its toe in the workstation market a few years ago, but got cold feet," says Bruce Jenkins, an analyst with Cambridge, Mass.-based Daratech Inc. "Sony seems rather more committed. Pacific-Rim hardware manufacturers have never had difficulty getting into U.S. markets once they decided what they needed to do."

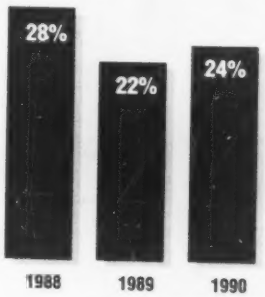
PETER BURROWS

EDA market to hit $2.24 billion

SALES OF electronic-design-automation products and services remain healthy, although at a slightly slower growth rate than in earlier years, according to a report from The Technology Research Group in Boston. EDA-related sales are expected to reach $2.24 billion this year, a 24% increase from the $1.89 billion in sales logged during 1989.

Healthy growth for EDA

(Revenue growth rate in the EDA market)



Source: Company reports

While exceeding last year's growth rate of 22%, expansion of the EDA market continues at a slower pace than the 28% market growth recorded in 1988. The report, "1990 EDA Market Overview," attributes the slower growth rate to market upheaval that was brought on by the wave of mergers and acquisitions that hit the industry in 1988 and 1989. Those changes, coupled with moves to establish standards governing EDA technologies, have caused potential customers to hesitate.

By early this year, the five EDA vendors with annual sales of more than $100 million accounted for 53% of all EDA sales, up from 37% in 1988, says the report. The five $100-million-plus companies are Mentor Graphics Corp., Cadence Design Systems Inc., Valid Logic Systems Inc., Daisy/Cadnetix Inc. and Racal-Redac Group Ltd.

RICK WHITING

dealer channel, which the company hopes will one day account for as much as 10% to 15% of all sales. But they also acknowledge that establishing the channel will take time.

Sun's customer-support requirement for dealers is critical, says Thomas Kucharvy, president of Summit Strategies in Boston, a market-research firm that follows workstations. He says that Sun has taken note of

Sun president Scott McNealy unveils plans to sell through resellers

the fact that VARs who employ on-site systems engineers to help customers have twice the sales of VARs that do not.

Sun's move is a good one, according to Kucharvy. Expanding into the dealer channel will help Sun increase workstation sales in commercial markets — a long-time goal. But by limiting the number of dealers that participate in the program and requiring them to add value, Sun hopes to avoid over-distribution that has plagued the PC retail market.

RICK WHITING

PERIPHERALS

As Conner stock soars, some investors cash in

CONNER PERIPHERALS Inc.'s stock price has jumped from the $10 range to nearly $25 per share in the past year as word has spread about the company's success. We've all heard how the hard-disk manufacturer has become the fastest-growing company in the history of American business. And many people have

COMPETITIVENESS

Warning flags are raised: Japan is top capital spender

THE COMPETITIVENESS of U.S. industry, electronics included, is in trouble, according to a recently released report by the Council on Competitiveness, a Washington, D.C.-based bipartisan group of 150 academics, labor leaders and industry executives.

One of the biggest concerns is the fact that Japan outspent the U.S. in plant and equipment last year for the first time since World War II. Japan shelled out a total $549 billion while the U.S. spent $513 billion, notes the Council. Part of the reason for Japan's huge spending is demographics. An aging population and an abhorrence of immigrant labor means capital-intensive factories will become even more essential for Japan's success in the 1990s.

While capital spending is the most critical element in overall U.S. competitiveness, there are other warning flags, according to the council.

- Germany and Japan each spend about 50% more of their gross national product on non-defense research and development than the U.S. does. Japan averages 2.9%, Germany 2.6% and the U.S. 1.6%.
- In total, 95% of Japanese students perform better on math and science exams than the top 5% of U.S. students.
- While the U.S. still leads in overall productivity (GNP per manufacturing worker), Japan, Germany and other industrialized nations are catching up rapidly. In 1987, the latest year for figures, the U.S. average was $38,800, Japan was $36,900 and Germany was $35,500.
- Germany's lead over the U.S. in standard of living broadened in 1989. Japan has doubled its standard of living since 1972.

The underlying message from the Council is that while the U.S. is still ahead in an overall "competitiveness index" — including capital investment, productivity, trade and standard of living — the competition is closing in rapidly. "We need to work on the [Federal] budget deficit, improve education, reduce the cost of capital and maintain public infrastructure spending," says Kent Hughes, president of the Council on Competitivenes.

Manufacturing-productivity growth in Japan and Germany are almost equal to that of the U.S. largely because of their strategy of heavy capital investment. Alternatively, "the U.S. has been cutting fat rather than adding muscle," says Hughes. "We have not put the best tools in the hands of the American worker." □

Report on shipments shows respectable growth

Shipments for first half of 1990

Industry sector	($ billions)	(% change)
Electronic components	28.1	5.0
Computer and industrial electronics	46.2	4.0
Communications	35.6	8.0
Consumer	3.4	5.3
Other electronics	27.0	5.0
Defense electronics	27.0	0.0

Source: Electronic Industries Association

Shipments of U.S. electronics equipment, excluding imports, rose by 5.4% in the first half of 1990 compared with the same period last year, reports the Electronic Industries Association. That is "a respectable growth rate," says EIA president Peter McCloskey, when compared with the rest of the economy.

LABOR

Skilled-labor shortage to intensify in '90s

NOW IS THE TIME for the U.S. to adjust to the coming slowdown of skilled workers entering industry in the 1990s, experts say. The baby bust of the 1970s and 1980s will make itself felt in the 1990s as the U.S. work force shrinks to an average growth rate of only 1.2% a year down from 2.0% a year in the '80s, according to the U.S. Bureau of Labor Statistics.

Exacerbating the slowdown is the changing composition of the work force. Women and minorities, including African Americans and Hispanics, will account for 88.4% of its net growth over the next ten years. Based on educational history, experts say that this group will be ill-prepared to provide the ever-increasing skill level needed by high-technology manufacturing.

"The much-lamented skills gap is expected to worsen," says a recent publication by the National Center for Manufacturing Sciences. "Down the road, we may even run into shortages of professional engineers and scientists."

In 1989, both the African American and Hispanic segments accounted for only 3% of all engineering degrees earned in the U.S. The meager representation is attributed to class differences and lack of early exposure to science and math, say many experts.

What should technology companies be doing now? First of all, they can support education, both in the public school systems and through retraining programs. While most companies now spend their money on training management, the '90s will see a shift to more spending on training skilled labor. Companies should also pay more attention to motivating and retaining older employees.

BRUCE C.P. RAYNER

In the throes of change: Europe's top companies

With events unraveling at a blistering pace, the ELECTRONIC BUSINESS top 50 European electronics companies are shaping a brave new world

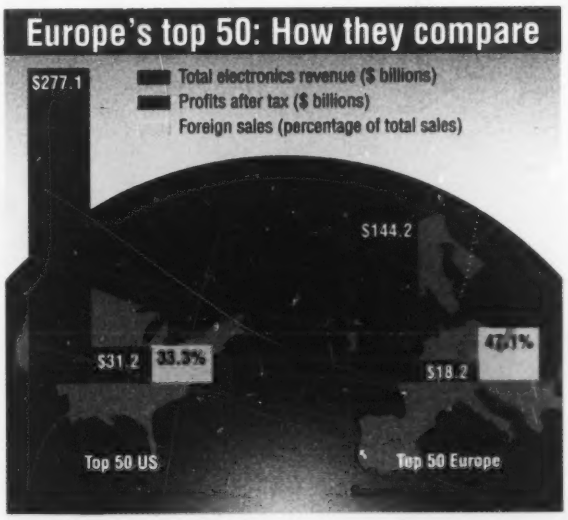
BY BRUCE C.P. RAYNER AND LINDA STALLMANN

In less than a month, free all-German elections will take place for the first time since 1933. A unified Germany, at the center of a new Europe, is destined to become the pivotal player for electronics business on the continent. A year ago, such a scenario would have been dismissed out of hand.

How quickly things change. Mergers, acquisitions, joint development deals and new investments are shaking up the landscape of Europe's electronics industry almost daily. While Japanese and U.S. companies are vying for European market share, it is European companies that are largely in the vanguard of change.

The ELECTRONIC BUSINESS 50, a listing of the largest publicly held European electronics companies, spells out the financial details of these movers and shakers. In 1989, total electronics revenue for the top 50 companies was $144.2 billion and total profits were $18.2 billion.

At the top of this year's European list is N.V. Philips, with electronics revenue of $21 billion. The company recently underwent a very un-Philips-like top management shakeup. The new president, Jan Timmer, replaced Cor van der Klugt, who critics claim botched Philips' attempt to restructure. No-nonsense Timmer is mercilessly slashing 10,000 jobs worldwide and cutting costs in an attempt to bring the company in step with the new dynamic Europe.



In front of the curve is Siemens AG, which is a close second to Philips. The Munich-based electronics and electronics engineering company has positioned itself at the center of a unified Germany and has recently undergone a successful streamlining, according to some analysts. It is investing heavily in Eastern Europe while others, most notably Japan's Fujitsu Ltd., are looking to invest in Siemens.

Who controls Siemens could be the hot topic of 1991. □

Notes on the ELECTRONIC BUSINESS Top 50 European Electronics Companies

Electronics sales: This is either a published figure or an ELECTRONIC BUSINESS estimate of the revenue earned by each company from the sale of electronics products. The figure is based on the latest available completed fiscal year.

Fixed assets per employee: The accumulated value, less depreciation, of land, buildings, plant, machinery, furniture and fittings, including rental equipment, that the company has invested per employee.

Investments as a percentage of sales: The summation of capital expenditures and research and development expenditures divided by total consolidated sales.

Return on gross capital employed: Profits before taxes, divided by net working capital plus fixed assets and financial investments.

Capital expenditures as a percentage of sales: The amount of new investment in fixed assets during the year divided by total consolidated sales.

Foreign sales as a percentage of total sales: Sales outside the company's country of origin (i.e., where the company is registered).

Exchange rates: All financial information presented in dollar terms has been converted using an annual average exchange rate for each company's fiscal year. □

Top electronics companies in Europe — 1989

Rank	Company	Electronics sales ($ millions)	Electronics sales as a percentage of total sales	Total consolidated sales ($ millions)	Profit before tax as a percentage of sales	Profit after tax as a percentage of sales	Sales per employee	Profit before tax per employee
1	Philips	$21,078	78%	$26,992	2.2%	1.4%	$88,558	$1,961
2	Siemens	20,290	62%	32,659	4.6%	2.6%	89,477	4,080
3	CGE	13,247	59%	22,572	5.3%	3.4%	107,333	5,682
4	Thomson	11,184	93%	12,026	2.2%	0.6%	120,190	2,634
5	GEC plc	7,370	52%	14,153	9.9%	6.2%	87,362	8,671
6	Robert Bosch	6,615	41%	16,277	6.6%	2.0%	93,150	6,190
7	Olivetti	6,586	100%	6,586	NA	2.2%	115,669	NA
8	Ericsson	5,534	90%	6,129	8.1%	4.7%	88,536	7,215
9	Groupe Bull	5,133	100%	5,133	-0.5%	-0.8%	117,678	-633
10	STC	4,269	100%	4,269	10.7%	6.8%	117,298	12,506
11	Nokia	3,589	64%	5,627	2.6%	1.2%	136,247	3,610
12	British Telecom	2,775	14%	19,837	18.7%	12.3%	80,018	14,957
13	AEG	2,767	42%	6,516	2.5%	2.2%	83,831	2,102
14	Asea Brown Boveri	2,680	13%	20,560	4.4%	2.9%	108,500	4,808
15	Memorex Telex	1,983	100%	1,983	-1.6%	-3.0%	204,470	-3,256
16	Bayer	1,913	8%	23,041	9.5%	4.9%	135,377	12,835
17	Grundig	1,903	100%	1,903	4.8%	4.1%	97,973	4,719
18	Racal Electronics	1,861	59%	3,179	10.2%	5.9%	84,975	8,670
19	Fiat Group	1,677	4%	37,934	NA	6.3%	132,499	NA
20	Ferranti International	1,642	100%	1,642	1.4%	0.7%	66,870	944
21	Matra	1,584	46%	3,465	4.8%	2.7%	163,103	7,797
22	Italtel	1,568	100%	1,568	0.0%	5.2%	93,541	NA
23	Schlumberger	1,500	32%	4,686	11.3%	9.0%	101,869	11,537
24	Mannesmann	1,334	11%	11,883	4.7%	2.3%	94,469	4,418
25	SGS-Thomson	1,200	100%	1,200	0.6%	0.3%	62,518	358
26	Amstrad	1,075	100%	1,075	12.2%	8.2%	652,840	79,854
27	Ciba-Geigy	1,068	8%	12,604	NA	7.6%	136,184	NA
28	Thorn EMI	966	16%	5,985	8.5%	5.5%	97,916	8,367
29	British Aerospace	954	6%	14,874	3.7%	2.6%	118,423	4,341
30	Smith Industries	940	78%	1,205	15.9%	10.5%	87,953	13,943
31	Lex Service	847	26%	3,275	2.8%	1.8%	380,422	10,612
32	Lucas Industries	715	20%	3,567	9.0%	6.9%	63,746	5,716
33	BICC	704	11%	6,208	5.3%	3.1%	134,859	7,148
34	Hoechst	595	2%	24,424	9.0%	4.6%	144,270	13,032
35	Oerlikon-Buhrle	550	19%	2,904	0.1%	-0.9%	106,287	141
36	Cable and Wireless	497	13%	3,731	22.7%	14.1%	99,019	22,516
37	Unitech	450	96%	467	8.2%	4.5%	75,305	6,184
38	Electrocomponents	419	66%	635	14.9%	9.5%	167,187	24,841
39	AB Electronic Products	358	100%	358	7.3%	4.6%	67,700	4,940
40	Norsk Data	358	100%	358	-15.7%	-10.9%	121,728	-19,057
41	Siebe	350	16%	2,150	12.4%	8.0%	70,396	8,755
42	ICI	300	1%	21,564	11.6%	7.1%	161,162	18,685
43	Cambridge Electronic	286	100%	286	6.3%	3.7%	58,795	3,724
44	ADT	240	25%	961	30.2%	27.8%	53,400	16,133
45	Farnell Electronics	228	83%	276	18.1%	10.9%	89,688	16,194
46	Rank Organisation	220	12%	1,829	26.6%	16.5%	80,232	21,368
47	Bowthorpe Holdings	206	54%	379	19.2%	12.4%	82,231	15,816
48	ASM International	196	100%	196	4.0%	2.3%	88,714	3,587
49	Pharos	194	87%	222	7.3%	4.3%	141,933	10,405
50	Apricot Computers	187	100%	187	5.7%	3.8%	158,249	8,995

NA = Not available

1 Foreign sales are sales outside of Europe

2 Foreign sales are sales outside of Scandinavia

Profit after tax per employee	Fixed assets per employee	Investments as a percentage of sales	Return on gross capital employed	R&D as a percentage of sales	Capital expenditures as a percentage of sales	Foreign sales as a percentage of total sales	Fiscal year ended	Country of origin
$1,226	$28,779	13.5%	3.6%	8.0%	5.5%	42.7%	12/89	Netherlands
2,308	20,348	18.0%	5.7%	11.2%	6.7%	53.0%	9/89	Germany
3,683	18,137	12.3%	11.5%	7.5%	4.8%	56.5%	12/89	France
779	17,724	11.3%	4.7%	5.5%	5.9%	71.9%	12/89	France
5,399	10,620	12.3%	25.3%	9.6%	2.8%	62.4%	3/90	Britain
1,906	**15,311**	**12.6%**	**15.4%**	**5.9%**	**6.7%**	**52.0%**	**12/89**	**Germany**
2,597	**NA**	**14.4%**	**NA**	**5.3%**	**9.2%**	**63.0%**	**12/89**	**Italy**
4,126	**17,408**	**17.7%**	**14.7%**	**10.9%**	**6.8%**	**84.3%**	**12/89**	**Sweden**
-959	**32,340**	**18.2%**	**-1.1%**	**9.0%**	**9.2%**	**25.4%**	**12/89**	**France**
7,927	**20,541**	**17.3%**	**34.3%**	**10.4%**	**6.9%**	**33.8%**	**12/89**	**Britain**
1,638	32,103	10.9%	5.6%	5.1%	5.9%	52.0%	12/89	Finland
9,805	96,041	27.1%	16.2%	1.9%	25.3%	0.0%	3/90	Britain
1,883	NA	12.3%	267.0%	6.4%	5.9%	46.1%	12/89	Germany
3,108	21,357	10.4%	8.7%	6.6%	3.8%	37.1%	12/89	Switzerland
-6,190	20,971	2.2%	-6.9%	1.3%	0.9%	1.6%	3/90	Netherlands
6,616	**38,088**	**14.2%**	**15.8%**	**6.2%**	**8.0%**	**41.2%**	**12/89**	**Germany**
4,010	**19,065**	**10.8%**	**13.1%**	**4.0%**	**6.8%**	**48.6%**	**3/89**	**Germany**
5,036	**30,466**	**18.2%**	**20.9%**	**4.1%**	**14.1%**	**54.0%**	**3/90**	**Britain**
8,391	**NA**	**10.0%**	**NA**	**3.4%**	**6.6%**	**NA**	**12/89**	**Italy**
483	**18,060**	**7.2%**	**3.5%**	**NA**	**7.2%**	**61.3%**	**3/89**	**Britain**
4,468	31,325	8.2%	9.0%	2.0%	6.1%	41.9%	12/89	France
4,890	NA	16.7%	NA	10.5%	6.2%	NA	12/89	Italy
9,129	35,822	18.9%	17.7%	7.2%	11.7%	62.1%	12/89	Netherlands
2,135	16,385	5.2%	13.0%	NA	5.2%	63.6%	12/89	Germany
170	40,373	31.8%	0.7%	13.3%	18.5%	43.0%	12/89	Netherlands
53,253	**46,311**	**2.4%**	**28.4%**	**NA**	**2.4%**	**59.5%**	**6/89**	**Britain**
10,289	**73,696**	**19.7%**	**NA**	**10.1%**	**9.6%**	**59.0%**	**12/89**	**Switzerland**
5,342	**29,682**	**13.6%**	**27.4%**	**0.9%**	**12.6%**	**54.0%**	**3/90**	**Britain**
3,037	**36,302**	**11.5%**	**4.4%**	**2.0%**	**9.5%**	**61.5%**	**12/89**	**Britain**
9,201	**13,505**	**18.6%**	**35.1%**	**15.3%**	**3.2%**	**72.4%**	**7/89**	**Britain**
7,017	26,757	2.3%	15.7%	NA	2.3%	23.1%	12/89	Britain
4,381	19,765	10.8%	16.1%	5.4%	5.4%	64.2%	7/89	Britain
4,125	15,684	2.7%	26.6%	0.6%	2.1%	55.0%	12/89	Britain
6,695	38,301	12.7%	19.6%	5.7%	7.0%	77.1%	12/89	Germany
-924	63,579	5.7%	0.1%	NA	5.7%	NA	12/89	Switzerland
14,000	**113,994**	**44.2%**	**15.7%**	**NA**	**44.2%**	**74.7%**	**3/90**	**Britain**
3,378	**20,562**	**7.2%**	**16.1%**	**2.9%**	**4.3%**	**65.0%**	**5/89**	**Britain**
15,939	**21,407**	**3.2%**	**40.6%**	**NA**	**3.2%**	**26.1%**	**3/90**	**Britain**
3,137	**12,351**	**4.4%**	**21.9%**	**NA**	**4.4%**	**26.0%**	**6/89**	**Britain**
-13,296	**49,046**	**18.0%**	**-22.8%**	**10.1%**	**7.8%**	**49.3%**	**12/89**	**Norway**
5,643	25,070	3.5%	19.3%	NA	3.5%	85.4%	3/89	Britain
11,380	59,419	12.4%	20.0%	4.2%	8.2%	77.9%	12/89	Britain
2,185	16,514	3.1%	13.5%	NA	3.1%	48.5%	12/89	Britain
14,861	51,206	22.8%	12.9%	NA	22.8%	83.2%	12/89	Britain
9,806	15,125	3.4%	33.3%	1.3%	2.1%	16.3%	1/90	Britain
13,228	**64,075**	**16.9%**	**18.0%**	**0.9%**	**16.0%**	**NA**	**10/89**	**Britain**
10,170	**15,555**	**7.4%**	**37.1%**	**2.6%**	**4.8%**	**71.9%**	**12/89**	**Britain**
2,048	**21,964**	**18.8%**	**9.1%**	**9.5%**	**9.2%**	**68.8%**	**12/89**	**Netherlands**
6,056	**10,673**	**2.6%**	**17.4%**	**NA**	**2.6%**	**88.8%**	**12/89**	**Sweden**
5,937	**12,268**	**3.0%**	**22.2%**	**NA**	**3.0%**	**11.7%**	**3/89**	**Britain**

3 capital expenditures only, no R&D data available

Source: ELECTRONIC BUSINESS

Taiwan's new chip makers struggle for survival

Despite a flurry of new fab construction, many observers predict an industry shake-out for companies that can't find a niche

BY JOEL MCCORMICK

Taiwan's semiconductor industry is gearing up for major expansion, with a handful of new chip fabrication plants under construction or in planning. The number of companies with their own chip production fabs, which has grown from zero to seven during the past decade, is expected to double to 16 by 1993.

Despite the veneer of prosperity, which is fueling a construction mini-boom south of Taipei in the Hsinchu Science-Based Industrial Park, many industry obervers are predicting a thinning of the island's chip-making ranks before 1993.

They observe that the industry — nurtured by government incentive schemes and bankrolled by a stock market boom and infusions from Taiwan's $70 billion foreign exchange reserve — is reaching the stage where it must fend for itself. But its ability to compete globally is compromised by a host of problems, including intellectual inbreeding, under-used facilities, product duplication, patent battles, a lack of marketing expertise and poor timing.

Most of Taiwan's chip industry is in a serious muddle. "The market is too compact, and everyone is making the same things," says Yen Shou-bai, semiconductor analyst with Taipei's International Investment Trust Company. The standard fare is dialer chips, for the domestic, Korean and European markets and read-only memories (ROMs), for the domestic and U.S. markets. Part of the duplication problem is that all product ideas still come from one source, the government-financed Electronics Research and Service Organization (ERSO), says Yen.

"I think there will be a shake-out, not necessarily a collapse; some [firms] will just fade away," says Yang Ding-yuan, president of three-year-old Winbond Electronics Corp., one of Taiwan's younger chip makers. Although he predicts consolidation for the industry, Yang doubts it will occur through mergers. "In Oriental society, it's not nice to sell out to your competitor."

But tradition may have to bow to market realities. Many industry insiders expect consolidation in which the bigger companies buy up the smaller, struggling ventures or force them out of the market. The theory gets no argument from Quincy Lin, strategic planning director at Taiwan Semiconductor Manufacturing Company (TSMC), Taiwan's second-largest semiconductor maker. He tracks the level at which the island's fabs are being used, and he says it's falling.

Because many of Taiwan's chip makers are adding new production capacity, Lin says, the fab use rate fell from 51% in 1988 to 47% in 1989. This year he expects it to drop to 41%, with no real improvement in sight until 1993, when fab use is projected to climb back to 58% of capacity. Lin projects that by 1994, use will climb to around 70%, where it's likely to remain for the foreseeable future.

Laurent Zylberman

Yang Ding-yuan, Winbond's president, thinks there will be a shakeout. "Some [firms] will just fade away"

The figures point to a painfully slow return on huge investments — too slow for some companies. "Some will crack," Lin says. When they do, fabs will be taken over by the survivors, although he says TSMC won't be shopping for any because the ones for sale will be at the low end, capable of only 2.5-micron to 3-micron line width.

International Investment Trust analyst Yen says Taiwan's chip companies need to do some serious strategic planning to avoid product duplication in the future. "There's still room to grow," she says, but companies can't survive unless they develop unique specialities and stick to the tried-and-true niche formula. As she sees it, Taiwan's chip industry "can't win in the commodity game."

Such warnings didn't stop Taiwan PC maker Acer Inc. from forming a joint venture with Texas Instruments Inc. last year to make 1-megabit and 4-megabit dynamic random access memories (DRAMs) at a plant now being built in the Hsinchu science park. The $250 million plant is designed to house two fabs, but the decision on whether to install the second — which may be used for 16-megabit DRAMs — won't be made until 1993.

Industry officials look to the Acer-TI joint venture to raise the general tenor of R&D activity in the science park. "Any investment in high technology will benefit Taiwan," says

Winbond chief Yang. "It's good for standards, it's good for training and it means a more stable supply of DRAMs."

New strategies

Most of Taiwan's semiconductor companies are only now beginning to map strategies that analysts say should have been in place long ago. Companies are slowly pulling back from overlapping production of commodity chips and starting to target niche markets, says Archie Yeh, deputy director of the system design technology division for the government-backed Industrial Technology Research Institute (ITRI). But the change is taking place too slowly, he warns.

Semiconductor companies in Taiwan are releasing their latest VGA graphics chip products, for example, at a time when the VGA market is already saturated. "If they came out a year ahead, they could have had good margins," says Yeh.

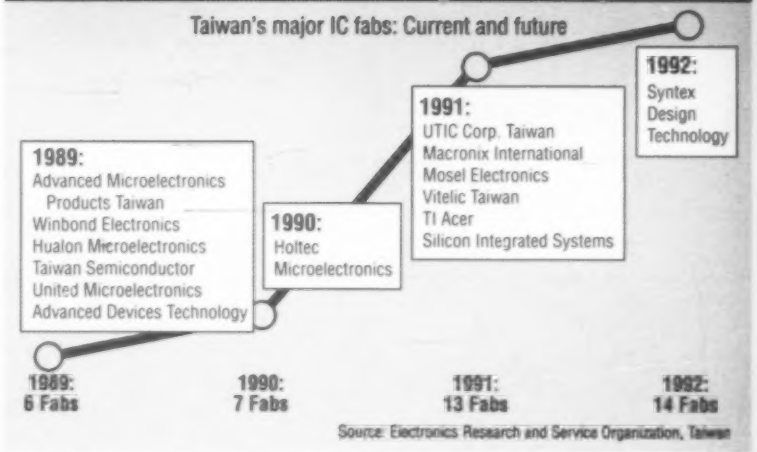
Taiwan's chip industry has to free itself from its conservative mind-set and take risks, Yeh says, in order to escape from the treadmill of introducing tried-and-true products at the market's lowest price point. To bring truly original products to market, he says, Taiwan chip companies have to dedicate themselves to product design, first by improving their design-automation capability but also by discarding bad habits like reverse engineering to produce modified chip designs.

"They need to change to a behavioral, architecture-level, top-down design approach," Yeh says. Companies shouldn't focus on the chip, but rather on the system the chip is helping to build, he says.

Yeh's prescription may rattle a few industry conservatives in Taiwan. But he argues it is the only possible strategy that can work in the long term, especially as a growing number of Taiwan companies make plans to venture into the high-risk world of DRAM production. Unless they come up with original products and catch the market at its peak, he says, companies risk big losses in this highly volatile sector.

Winbond's vice president for manufacturing, Ho Chun, thinks the industry can make the necessary changes. "By 1994-'95, companies will be able to stand on their own

Big plans, but will they materialize?



Source: Electronics Research and Service Organization, Taiwan

and differentiate themselves from one another," he says. Winbond's differentiation strategy calls for a gradual move away from telecommunications chips, which now account for nearly 60% of its sales volume. The rest comes from memories and PC-related chips.

Winbond has been considering DRAM production, but has been reluctant to commit itself to such an expensive proposition. "If we're going into DRAMs, we need human technology, financial and manufacturing commitment," says Winbond president Yang. That means finding design partners with the expertise and resources to develop more than a single design.

The figures point to a painfully slow return on huge investments — too slow for some companies

Partnering on the horizon

Winbond's Ho has been talking to potential design and systems partners, which he declines to identify. The idea, he says, is that partnerships should help protect the company from cyclical downturns, give it a clearer picture of the market, help focus R&D and share the marketing load. He adds, however, that Winbond probably will have to lower prices and cede some fab capacity and design resources in return for its partners' contributions.

Hualon Microelectronics Co. marketing director Eric Cheng says his company is trying to divine what the world will need to run the next generation of home and office automation products. "We're looking for that cash cow," he says. Meanwhile, the company's 150 engineers work on expanding HMC's range of computer, telecom and consumer IC products.

HMC's main goal in the next five years is to develop the products that will bring high production volumes and profits. Until then, he says, "we want to improve our capability and yield to compete with Japan and Korea." That will mean continued emphasis on the company's static RAM and electrically programmable ROM chips, as well as making submicron DRAMs in the near future.

TSMC is aiming for submicron production at its two existing fabs and will have its hands full by 1993 when its third fab is complete and in full production. Lin insists that TSMC, which is part owned by N.V. Philips, is only interested in being a foundry for chips designed by other companies. "Recently, we've added some computer-aided design equipment because companies said they needed the tools. But it's to help our customers," Lin says. "We're not in the design business."

While there is some doubt about

TSMC's capacity use, the company's foundry strategy appears to be paying off. In May, the company penned an agreement with Intel Corp. to begin making DRAMs. Initial production of 256-kilobit DRAMs already has begun, and is supposed to reach 2 million to 3 million chips a month by late summer. Production of 1-megabit chips is scheduled to begin by the fourth quarter and further negotiations are under way to eventually expand the arrangement to 4-megabit chips.

"Intel is very concerned about quality so it's a vote of confidence in TSMC," says Lin. It's also a big opportunity for TSMC to develop high-volume DRAM manufacturing expertise, as well as absorbing Intel's process technology. Although rights to the DRAM chip designs stay with Intel, which purchased them from Alliance Semiconductor Corp., TSMC gets to keep the process technology and put it to work for other customers. In Lin's estimation, this alliance pushes Taiwanese capabilities another step closer to world-class standards for semiconductors.

United Microelectronics Co., Taiwan's first homegrown semiconductor company and also its largest with 1989 sales of $130 million, is quickly expanding its own technology base, according to UMC president Robert Tsao. Roughly 85% of the company's products are now designed in-house, he says, although not all designs are entirely original. "There's a gray area where we modify others' designs," he admits.

Sales are picking up after UMC's first quarter $5.5 million loss, and with financial clouds beginning to lift, Tsao is sounding more optimistic. "It should be very good in the third and fourth quarters," he says. Earnings jumped to $7.3 million in the second quarter and are projected to hit $10.9 million in the third.

Tsao predicts tough sailing for newcomers Winbond and HMC as the industry rationalizes overlapping products. "But the situation is changing rapidly," he adds. "Everyone is trying to find their own niche and avoid head-on competition."

Tsao says there were legitimate reasons Taiwan's chip companies duplicated so many of the same chips. "A major concern every semiconductor manufacturer has is increasing production loading. I don't think any company can afford to do only certain ICs," he says. Even Japan's advanced memory makers don't miss the chance to make consumer products when there is capacity to spare, Tsao says.

As for UMC, "We're trying to figure out in what area we can be a world leader in four or five years," says Tsao. That area won't be DRAMs, he insists, but it could be PC chip sets and peripheral controller sets.

To grab their share of market growth, Taiwan's semiconductor firms must upgrade marketing skills

Improving technology

Raising the level of technology might also help raise the level of self-esteem among Taiwan's chip makers, says James Koo, senior vice president for corporate marketing at U.S.-based Vitelic Corp. "I have a feeling they look into the mirror and don't like what they see," he says. "They like to project the image of being very high-end but really they're at the bottom of the totem pole."

Bill McClean, market research manager at industry researcher Integrated Circuit Engineering Corp. (ICE) in Scottsdale, Ariz., agrees that Taiwan's chip sector is being challenged on cash, marketing and technology fronts.

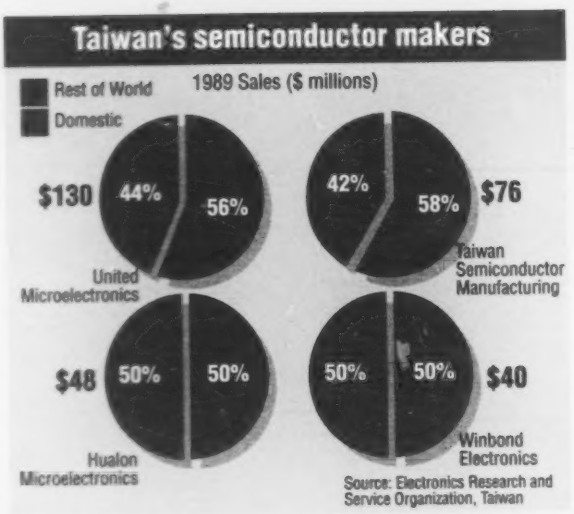
If Taiwan makers have the financial stamina to hold out, he says, their new leading edge fabs should be running at full capacity within six months. That should coincide with ICE's forecast of a general industry upswing, in which worldwide chip sales will grow 14% in 1991, and 25% by 1992. But to grab their share of that market growth, he says, Taiwan's companies must upgrade marketing skills.

"The thing Taiwan tends to overlook is that you really need to develop a worldwide marketing network for sales," he says. "UMC doesn't have significant sales in the U.S. When people think semiconductors, UMC doesn't come to mind."

McClean allows that production and sales channel agreements like the TSMC-Intel arrangement might help create a higher profile for Taiwan's industry. On the other hand, he says, a recent, similar deal between Japan's NMB Semiconductor Co. and Intel Corp. has produced few market gains to date.

A lack of worldwide sales channels is one reason ICE's McClean doubts Taiwan will achieve its goal of making 4.5% of the world's semiconductors by 1995. "I think 2% by 1994 is more realistic," he says. That's still $1.5 billion of what will then be a $75 billion global market.

But whether today's Taiwan chip makers will be around to share that booty is an open question. "Taiwan companies don't have the deep pockets that the Koreans and Japanese have," McClean says. "Japan can take heavy hits for some time before it's going to hurt them." But for Taiwan's struggling young companies, one bad quarter can sometimes be devastating. □



Contract manufacturing: fast growth, low margins

Medium-size contract production specialists struggle to meet demand for sophisticated assembly technology

As original equipment manufacturers increasingly turn to contract manufacturing for product assembly, medium-size contract manufacturers are quickly adding capacity and expanding overseas to service their customers. But profit margins in this competitive industry are so slim they threaten to stymie future growth.

Contract manufacturers are fighting back by diversifying their customer base, assembling products with higher added value, offering more design services and boosting quality.

Electronic-equipment makers are designing products that require increasingly sophisticated assembly techniques such as surface mounting and tape-automated bonding, as well as chip-on-board technology. More and more of these OEMs are turning to contract manufacturers for production and technical expertise rather than investing in their own in-house manufacturing capabilities.

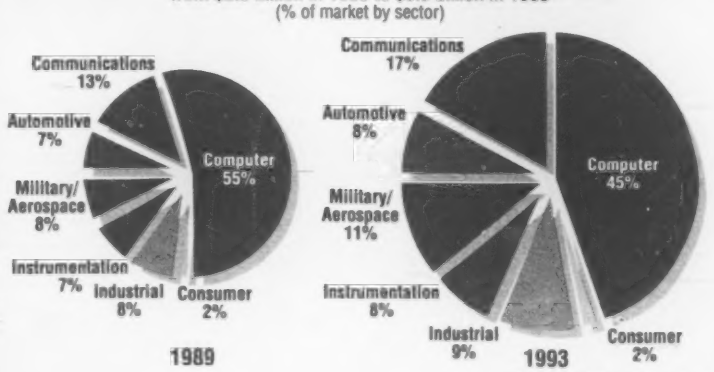
BY GIUSEPPE LABIANCA

The OEMs are also finding that contract manufacturing allows them to speed their time-to-market during a period in which product life-cycles are shortening because of intensifying competition.

To meet increased demand from OEMs, the total worldwide value of contract assembly will grow from $11.2 billion in 1989 to $18.7 billion in 1993, a 14% annual growth rate, according to Pamela Gordon, president of Berkeley, Calif.-based market researchers Technology Forecasters. The North American contract assembly market will expand at a 12% annual rate from $3.5 billion in 1989 to $5.5 billion in 1993, Gordon predicts in a report published by Electronic Trend Publications of Saratoga, Calif. Portions of the market are seeing even faster growth. Surface-mount assembly, for instance, will make up 56% of the total market in 1993, up from 44% in 1989.

Contract manufacturers diversify

Total North American contract-assembly market will grow from $3.5 billion in 1989 to $5.5 billion in 1993
(% of market by sector)



Source: Technology Forecasters

The biggest short-term challenge for the industry is to widen profit margins, says Winston Chen, president and CEO of Solectron Corp., the San Jose, Calif.-based contract manufacturing firm that went public in November 1989. The newest technologies like tape-automated bonding and multi-chip modules require huge investments in capital equipment and in qualified labor, as does the overseas expansion which many of the customers require. But financing is not readily available. "Contract manufacturing is a 'bad neighborhood' in the financial community," says Chen. Margins need to be higher throughout the industry, otherwise the financial community will continue shunning contract manufacturing, he says.

Solectron's sales have jumped from $42 million in 1986 to $130 million in 1989, with sales for the first three quarters of 1990 already over $145 million. "But we are growing too quickly," says Chen, who says it is too much of a challenge to maintain margins, groom management and maintain excellent service for customers while continuing to grow at a 50% annual rate. He plans to hold further growth to about 25% a year. "I think that many electronics firms try to grow too quickly," says Chen. "And when you force a weightlifter whose limit is 500 pounds to lift a 700 pound weight, you kill him."

Rapid expansion

The rapid expansion of the contract-assembly market has brought its problems. The story unfolding at Fremont, Calif.-based Flextronics, Inc. — which was the second largest contract manufacturer in North America before suffering losses of over $33 million in 1989 and 1990 — is evidence of the growing pains which may strike smaller contract manufac-

turers on their meteoric rise. Flextronics' sales jumped from $51 million in 1986 to nearly $202 million in 1989. During that period, the firm invested heavily in new plants and equipment here in the United States. But then cost pressures within their customer base sent customers overseas for assembly. "The result was a capacity problem which took over a year to resolve, because the margins in this business don't allow for massive restructuring overnight," says Keith Scott, vice president of marketing and sales at Flextronics. In order to pay off some of its debt, Flextronics was forced to close a number of facilities in the U.S. and sell a stake in its Far East holdings to a group of Hong Kong investors in June 1990.

Scott believes that the problems Flextronics has faced will affect the other smaller contract manufacturers as they are challenged with rapid expansion. Once a company reaches $100 million to $200 million in revenue, he says, one plant usually isn't enough. Adequately responding to fast growth requires making decisions on plant site, service mix, equipment acquisitions, type of customers targeted and internal cost-accounting and material-handling systems within a very short time frame. This increases the margin for error.

SCI Systems, Inc., North America's largest contract manufacturer, is reining in its rapid expansion because of falling profit margins. The Huntsville, Ala.-based firm's sales have gone from $470 million in 1986 to $987 million in 1989, and they should top $1 billion in 1990. SCI has added five plants overseas to support their customers since late 1984 while also expanding capacity in the U.S. The heavy investment has put pressure on margins, according to A. Eugene Sapp Jr., president and chief operating officer. "As we enter the '90s, we are undergoing a transition from a top-line strategy to a bottom-line strategy," remarks Sapp. "We are going to stop the rapid expansion and we're going to focus on recovering our traditional margins." He says SCI is looking to boost profit margins between 5% and 6%.

Seeking new customers

To continue their revenue growth while boosting profit margins, many contract manufacturers are diversifying their customer base by moving out of the volatile computer and peripherals sector and into communications, military/aerospace, instrumentation, automotive and industrial controls. OEMs in these industries are beginning to recognize contract manufacturing as a mature industry and look to the industry to reduce the cost of assembling increasingly complex products, says Carol Maslona, business development manager for Philips Circuit Assemblies, a division of N.V. Philips. The company's facilities in Tampa, Fla., have seen increasing activity from the telecommunications sector. The computer sector accounted for 55% — about $1.9 billion — of the North American contract assembly market in 1989, according to Technology Forecasters, but that share of market will fall to 45% by 1993.

Slim profit margins

($ millions, calendar 1989)

Company	Sales	Net Profits (as % of sales)
Comptronix	$42.4	3.5%
Flextronics	$180.4	-12.9%
SCI Systems	$1,133.3	0.4%
Solectron	$143.1	3.3%
Weighted average		-0.8%
Total for EB 200 companies		4.8%

Source: Company reports

The move toward more complex boards means that contract manufacturers will offer more design services

Analyst Gordon believes communications will be one of the fastest growing sectors for contract manufacturers in the North American market. Communications accounted for $455 million in 1989 — about 13% of the North American market — and that will increase to $938 million or 17% of the market by 1993, according to Gordon.

Contract manufacturers are also looking to produce higher value-added products. Comptronix Corp., one of the rising stars in the industry, was burned by the loss of a major disk-drive customer in 1989 just as it went public. Analysts still project sales to rise from $42 million in 1989 to between $60 million and $80 million in 1990. But Comptronix is now moving away from low-end assembly of peripherals to higher value-added products such as medical electronics, industrial controls and high-end printers in an attempt to increase profitability, says William J. Hebding, chairman and CEO of the Guntersville, Ala.-based firm.

More design services

The move toward more complex boards means that contract manufacturers are offering more design services to their customers. The challenge is to get potential customers not used to dealing with contract manufacturers to drop their adversarial attitude, says Roger Main, president and CEO of Newark, N.Y.-based contract manufacturer IEC Electronics Corp. The formation of true partnerships with these OEMs is essential to continued growth for the industry. But keeping up customer service while expanding rapidly is very difficult. "Some people in this industry have forgotten that it is a service industry," says Main. He adds that contract manufacturers must recognize that flexibility and working for the OEMs' best interests rather than to the letter of a contract will be in their own interests in the long run.

The bigger contract manufacturers are expanding into Europe and the Far East in their attempts to service their local customers globally. Solectron's Chen believes that American manufacturing firms' quality deficiencies will be accentuated as they attempt to compete against foreign manufacturers overseas. "I don't think our industry is working hard enough to compete on a global basis," says Chen, whose firm applied for the Malcolm Baldrige National Quality Award in 1989 and 1990. He believes the whole industry must set its manufacturing standards in terms of quality management, inventory and cycle-time control. Chen adds, "We have to devote more money and investment to quality." ►

CONTRACT MANUFACTURING

Contract manufacturing directory

This is an exclusive list compiled by ELECTRONIC BUSINESS assistant editors Xiong Xiaoge and Giuseppe Labianca.

Over $50 million

ADI Corp.
14F No. 1, Sec. 4, Nan-King E. Road, Taipei, Taiwan, R.O.C.; Tel: (02) 713-3337, Fax: (02) 713-6555; Connie Hsu, Marketing Specialist; a,b,d

AG Communication Systems Corp.
400 North Wolf Rd., Northlake, IL 60164; Tel.: (708) 681-7100, Fax: (708) 681-7090; Frank McKay, Director of Manufacturing Sales; a,b,c,d,e

AVEX Electronics Inc.
4807 Bradford Dr., Huntsville, AL 35805; Tel.: (205) 722-6301, Fax: (205) 722-6232; Susan Crossett, Marketing Administrator; a,b,c,d

Comptronix Corp.
1800 Gunter Ave., Box 1800, Guntersville, AL 35976; Tel.: (205) 582-1800, Fax: (205) 582-1817; Allen Shifflett, President; b,c,d

Dover Electronics Manufacturing
Eastern Division
Kirkwood Industrial Park, Box 5212, Binghamton, NY 13902; Tel.: (607) 772-7563, Fax: (607) 772-0868; Robert Egan, Sales Manager; a,b,c,d

Western Division
1198 Boston Ave., Longmont, CO 80501; Tel.: (303) 772-5933, Fax: (303) 776-1883; John Goheen, Sales Manager; a,b,c,d

EMD Associates
4065 Theurer Blvd., Winona, MN 55987; Tel.: (507) 452-8932; Ted Engler, Sales Manager; a,b,c,d

Flextronics Inc.
34551 Ardenwood Blvd., Fremont, CA 94555; Tel.: (415) 794-3539, Fax: (415) 745-7897; Sue Mucha, Director, Marketing Service; a,b,c,d

IEC Electronics Corp.
105 Norton St., Newark, NY 14513; Tel.: (315) 331-7742, Fax: (315) 331-3547; Frank Montabana, Director Marketing & Sales; a,b,c,d,e

International Microelectronic Products
2830 North First St., San Jose, CA 95134; Tel.: (408) 432-9100, Fax: (408) 434-5904; Dean Winkelmann, Marketing Manager; d

Jabil Circuit Co. Inc.
10800 Roosevelt Blvd., St. Petersburg, FL 33716; Tel.: (813) 577-9749, Fax: (813) 579-8529; Mark Burman, V.P. Business Development; a,c,d

NCR Component Evaluation Technology Center
3450 North Rock Rd., Bldg. 100, Wichita, KS 67226; Tel.: 1-800-622-CETC, Fax: (316) 636-4780; Kent Wade, Executive Account Manager; c

Philips Circuit Assemblies
2601 South Moorland Rd., New Berlin, WI 52151; Tel.: (414) 785-6364, Fax: (414) 785-6517; Don Weiland, Director of Marketing/Engineering; a,b,c,d

Plexus Corp.
55 Jewelers Park Dr., P.O. Box 156, Neenah, WI 54957; Tel.: (414) 722-3451, Fax: (414) 722-3220; Chuck Williams, V.P. Marketing; a,b,c,d,e

SCI Manufacturing Inc.
4000 South Memorial Parkway, Huntsville, AL 35807; Tel.: (205) 882-4400; Michael Realz, Senior V.P. Atlantic Div.; a,b,c,d,e

Solectron Corp.
2001 Fortune Dr., San Jose, CA 95131; Tel.: (408) 942-1943, Fax: (408) 262-3973; Joe Byrne, V.P. Marketing; a,b,c,d,e

Sparton Electronics
Johnson Lake Rd., P.O. Box 788, DeLeon Springs, FL 32130; Tel.: (904) 985-4631, Fax: (904) 985-5036; Alan Houghtaling, Sales Manager; a,b,c,d

Teledyne Lewisburg
PO Box 326, 1425 Higgs Rd., Lewisburg, TN 37091; Tel.: (615) 359-4531, Fax: (615) 359-2085; John Murphy, Marketing Manager; a,b,c,d

Texas Instruments Inc.
3000 Bill Garland Rd., Johnson City, TN 37605; Tel.: (615) 461-2721, Fax: (615) 461-2372; Dave Autrey, Manager, Business Development; a,b,c,d,e

Westinghouse Process Control Div.
200 Beta Dr., Pittsburgh, PA 15238; Tel.: (412) 963-4949, Fax: (412) 963-4063; Van Walker, Marketing Manager; a,b,c,d

TYPE OF SERVICE

- a Design
- b Product assembly
- c Testing
- d Turnkey manufacturing
- e Cable and harness assembly

$20 million to $50 million

A.J. Electronics Inc.
20945 Plummer St., Chatsworth, CA 91311; Tel.: (818) 998-8788, Fax: (818) 998-3758; Martin Goodwin, Executive V.P.; b,c,d

Array Technology
1297 Parkmoor Ave., San Jose, CA 95126; Tel.: (408) 297-3333, Fax: (408) 297-3763; Larry McFall; a,b,c,d

Benchmark Electronics Inc.
802 West Brazospark Dr., Clute, TX; Tel.: (409) 265-0991, Fax: (409) 265-7804; Steve Barton, V.P. Sales; a,b,c,d

EOG Inc.
10947 Golden West Dr., Hunt Valley, MD 21030; Tel.: (301) 785-3000, Fax: (301) 771-5814; Arthur Rutledge, Jr., V.P. Marketing & Sales; a,b,c,d,e

Hibbing Electronics Corp.
3125 East 14th Ave., Hibbing, MN 55746; Tel.: (218) 263-8971, Fax: (218) 263-8970; Michael Walsh, Marketing Manager; a,b,c,d,e

The JPM Co.
Route 15 North, Lewisburg, PA 17837; Tel.: (717) 524-8200, Fax: (717) 523-7555; Dick Krass, Director of Marketing & Sales; e

Manu-Tronics Inc.
8701-100th St., Kenosha, WI 53142; Tel.: (414) 947-7700, Fax: (414) 947-7729; Roger Mayer, President; a,b,c,d,e

Varian Tempe Electronics Div.
615 South River Rd., Tempe, AZ 85281; Tel.: (602) 968-6790, Fax: (602) 894-5381; Douglas Kim, Marketing Manager; a,b,c,d

XCEL Corporation
3300 New York Dr., Pasadena, CA 91107; Tel.: (818) 791-5600, Fax: (818) 791-9788; Sam Calvillo, Director of Sub-Systems Engineering & Manufacturing; a,b,c,d

XETEL Corp.
8100 Cameron Rd., Suite 150, Austin, TX 78759; Tel.: (512) 834-2266, Fax: (512) 834-9250; Mark Trutna, Director of Sales; a,b,c,d

$5 million to $19 million

Adco Circuits Inc.
1900 Northfield Dr., Rochester Hills, MI 48309; Tel.: (313) 853-6620, Fax: (313) 853-6698; Archie Damman, Vice President; a,b,c,d,e

Altek Co.
245 East Elm St., Box 1128, Torrington, CT 06790; Tel.: (203) 482-7626, Fax: (203) 496-7113; Stephen Altschuler, President; a,b,c,d,e

Altron Inc.
6700 Industry Ave., N.W., Anoka, MN 55303; Tel.: (612) 427-7735, Fax: (612) 427-3980; Alan Phillips, President; b,c,d,e

Assembly Shop Inc. (ASI)
9939 Via Pasar, San Diego, CA 92126; Tel.: (619) 566-9880, Fax: (619) 566-4525; Tim Mullennix, Vice President; b,c,d,e

Bibco Inc.
326 East Main St., Benton Harbor, MI 49022; Tel.: (616) 925-8445, Fax: (616) 925-3081; Paul Pantaleo, Sales Manager; b,c,e

Cerberus Pyrotronics
8 Ridgedale Ave., Cedar Knolls, NJ 07927; Tel.: (201) 397-7272, Fax: (201) 397-7008; Robert Papp, Manager of Contract Manufacturing Unit; b,c,d

(Continued)

Continental Testing Laboratories
8385 South U.S. Highway 17-92, Fern Park, FL 32703; Tel.: (407) 831-2700, Fax: (407) 260-2053; Brian Hickey, Marketing Manager; c

Corinth Telecommunications Corp.
Fulton Dr., Corinth, MS 38834; Tel.: (601) 287-3771, Fax: (601) 287-1437; Jim Hopper, Vice President, Operations; b,c,d,e

Diagnostic Instrument Corp.
Box J, 4 Copeland Dr., Ayer, MA 01432; Tel.: (508) 772-4572, Fax: (508) 772-5210; James Hashem, President; b,c,d,e

E.I. (Ireland) Company, Ltd.
Shannon, Co. Clare, Ireland; Tel.: (353) 61-61277, Fax: (353) 61-61053; Mike Guinee, Chief Executive; a,b,c,d

Electronic Engineering Research
20845 Prairie St., Chatsworth, CA 91311; Tel.: (818) 709-1195, Fax: (818) 709-1377; H. Lawrence Medley, V. P./Director of Marketing; b,c,d,e

Electronics Systems Inc.
Box 5013, Sioux Falls, SD 57117; Tel.: (605) 338-6868, Fax: (605) 338-5061; Leo Reynolds, President & CEO; b,c,d

Express Manufacturing Inc.
3115 West Warner Ave., Santa Ana, CA 92704; Tel.: (714) 556-1878, Fax: (714) 556-0575; C.P. Chin, President; a,b,c,d

4th Generation
4 Pheasant Run, Newton, PA 18940; Tel.: (215) 968-5700, Fax: (215) 968-6094; Tony Tartaglia, Vice President; a,b,c,d,e

General Technology Corp.
6816 Washington N.E., Albuquerque, NM 87109; Tel.: (505) 345-5591, Fax: (505) 344-3227; Ralph Anderson, President; a,b,c,d,e

Kimchuck Inc.
Commerce Park, Corporate Dr., Danbury, CT 06810;Tel.: (203) 790-7800, Fax: (203) 797-8976; David Reed, Sales Manager; a,b,c,d,e

LMC
101 Gordon Dr., Lionville, PA 19353; Tel.: 1-800-628-3028, Fax: (215) 363-3009; Pat Tucci, Senior V.P. Sales & Marketing; a,b,c,d

L.T.I. Electronics
P.O. Box 2524, Houston, TX 77252; Tel.: (713) 862-7200, Fax: (713) 862-4580; Janet Noel, Manager of Sales & Marketing; b,c,d,e

Lamtech Electronics Corp.
620 Easy St., Garland, TX 75042; Tel.: (214) 272-3504, Fax: (214) 272-7176; Phillip Rasor, V.P. Sales & Marketing; b,c,d,e

Leetron Inc.
455 Industrial Dr., Warwick, RI 02888; Tel.: (401) 737-8250, Fax: (401) 732-0240; Norman Rena, Executive V.P.; b,c,d

MEP Controls
312 Rising Sun Rd., Bordentown, NJ 08505; Tel.: (609) 298-7303, Fax: (609) 298-1982; Hank Del Gatto, President; a,b,c,d

MLI Industries Inc.
3 East Main St., Apalachin, NY 13732; Tel.: (607) 754-5800, Fax: (607) 625-2011; Michael MacKenzie, President; b,c,d,e

MRL Industries Inc.
3800 West Clay St., St. Charles, MO 63301; Tel.: (314) 946-6900, Fax: (314) 946-2860; Will Hailiger, Marketing Manager; b,c,d,e

Micro Industries
691 Greencrest Dr., Westerville, OH 43081; Tel.: (614) 895-0404, Fax: (614) 822-6357; Michael Curran, General Manager; a,b,c,d

Milwaukee Electronics Corp.
7817 West Clinton Ave., PO Box 23345, Milwaukee, WI 53223; Tel.: (414) 358-4000, Fax: (414) 358-4001; James Scholler, Engineering Sales; a,b,c,d

National Telephone & Electronics Inc.
2350 NW 96th Ave., Miami, FL 33172; Tel.: (305) 592-0551, Fax: (305) 599-0948; J Ardolino, President; ab,d,e

Pine Instrument Co.
101 Industrial Dr., Grove City, PA 16127; Tel.: (412) 458-6391, Fax: (412) 458-4648; David Savage, Product Marketing Manager; a,b,c,d,e

Precision Graphics Inc.
59 LaGrange St., Raritan, NJ 08869; Tel.: (201) 707-8880, Fax: (201) 707-8884; Robert Weissman, President; a,b,c,d

QPL Electronic Dist. Inc., Cable Tek Div.
22 Terry Ave., Burlington, MA 01803; Tel.: (617) 229-2424, Fax: (617) 273-5075; Michael Shaw, President; e

RAMP Industries Inc.
1 North Floral Ave., Binghamton, NY 13905; Tel.: (607) 729-5256, Fax: (607) 729-2977; Charles Faciszewski, Sales Manager; b,c,d,e

Senior Systems Technology, Inc.
20131 Bahama St., Chatsworth, CA 91311; Tel.: 1-800-8000-SST, Fax: (818) 998-0664; Joe Candella, President; a,b,c,d,e

Superior Manufacturing Co.
3133 West Harvard St., Santa Ana, CA 92704; Tel.: (714) 540-4605, Fax: (714) 540-4542; Jim Van Landingham, Marketing Manager; a,b,c,d,e

TYPE OF SERVICE

a Design
b Product assembly
c Testing
d Turnkey manufacturing
e Cable and harness assembly

Tidewater Associates
3101 Whipple Rd., Suite 27, Union City, CA 94587; Tel.: (415) 487-5650; Michael Gifford, Director Marketing & Sales; a,b,c,d

Turtle Mountain Corp.
380 Oak Grove Parkway, St. Paul, MN 55127; Tel.: (612) 481-1427, Fax: (612) 481-7253; Van Barkus, Director, Sales Manager; b,c,d,e

Vern Kiebler Electronics Inc.
201 North Gables Blvd., Wheaton, IL 60187; Tel.: (708) 668-5407, Fax: (708) 462-7590; Bill Archbold, V.P. Marketing; a,b,c,d,e

Western Reserve Electronics Inc.
2150 Highland Rd., Twinsburg, OH 44087; Tel.: (216) 425-4951, Fax: (216) 425-4956; Robert Rhodes, Manager Marketing & Sales; a,b,c,d,e

Zercom Corp.
Zercom Dr., Box 84, Merifield, MN 56465;Tel.: (218) 765-3151, Fax: (218) 765-3900; Jeff Zernov, President; a,b,c,d,e

$1 million to $4.9 million

Acap Systems, Advanced Products & Technologies Division
306 River St., Haverhill, MA 01832; Tel.: (508) 374-8282, Fax: (508) 374-8183; Mark Dewolfe, Marketing/Sales Manager; b,c,d,e

Accurate Electronics Corp.
169 South Abbe Rd., Box 1287, Elyria, OH 44035; Tel.: (216) 366-6330, Fax: (216) 366-0522; R.B. Seybold, V.P.; b

Aerospace Industries Inc.
2101 Front St., Cuyahoga Falls, OH 44221; Tel.: (216) 928- 5002, Fax: (216) 928-5283; David Harry, Sales & Marketing; b,c,d

Automation Electronics
9640 Topanga Canyon Place, Bldg. J, Chatsworth, CA 91311; Tel.: (818) 998-5124, Fax: (818) 998-6654; Robert Aiani, Q.C. Engineer; e

Beta Industries Inc.
2860 Culver Ave., Dayton, OH 45429; Tel.: (513) 299-7385, Fax: (513) 299-0468; Tom Biel, Electronic Manager; b,d,e

"C" Enterprises
310-110 Via Vera Cruz, San Marcos, CA 92069; Tel.: (619) 744-8182, Fax: (619) 744-1659; Steve Rosoff, Vice President; e

DARE Electronics Inc.
3245 South County Rd. 25-A, Troy, OH 45373; Tel.: (513) 335-0031; Paul Gilmore, Sales/Applications Engineer; a,b,c

Data Signal Inc.
2403 Commerce Lane, Albany, GA 31708; Tel.: (912) 883-4703; William Sanders, President; a,b,c,d,e

Dunham Industries Inc.
17791 Skypark Circle, Suite D, Irvine, CA 92714; Tel.: (714) 261-2308, Fax: (714) 724-1610; Robert Dunham, President; b,c,d,e

Electra-ssembly
P.O. Box 30, 80 Cutler Street, Warren, RI; 02885; Tel.: (401) 245-5493; Richard Rosa, President; a,b,c,d

Electronic Professional Services Inc.
26351 Curtiss-Wright Pkwy, Cleveland, OH 44143; Tel.: (216) 289–4115, Fax: (216) 289-4116; Jack Bliss, Business Development Manager; a,b,c,d,e

The Electronics Group
2828 Interstate Street, Charlotte, NC 28208; Tel.: (704) 597–9500, Fax: (704) 391-9500; R. Gerald Butler, President; a,b,c,d

Electro-Support Systems
28060 Del Rio Rd., Temecula, CA 92390; Tel.: (714) 676-2751, Fax: (714) 694-0097; Paul Christianson, National Manager; a,b,c,d,e

Eveready Industry Corp.
2345 Bering Dr., San Jose, CA 95131; Tel.: (408) 943-1555, Fax: (408) 943-1248; John Jeng, Director of Engineering; b

(Continued)

CONTRACT

MANUFACTURING

Focus Electronics Inc.
1243 Hanley Industrial Ct., St. Louis, MO 63144; Tel.: (314) 968-3400, Fax: (314) 968-3401; Rick Filcoff, President; a,b,c,d,e

Force Inc.
825 Park St., Christiansburg, VA 24073; Tel.: (703) 382-0462, Fax: (703) 381-0392; Wendell Hensley, V.P. Marketing; a,b,c,d,e

Griffin Ltd.
1720 - J. Belmont Ave., Baltimore, MD 21207; Tel.: (301) 298-1710, Fax: (301)-265-8404; K. C. Goldstein, President; a,b,c, d,e

Halcyon Microelectronics Inc.
5467 Second St., Irwindale, CA 91706; Tel.: (818) 814-4688, Fax: (818) 960-8133; Dennis P. Martin, President, a,b,d

Hutronix Inc.
2400 S. 34th Place, Box 27566, Tucson, AZ 85726; Tel.: (602) 790-5348, Fax: (602) 790-8836; Robert Del Ghiaccio, V.P. Marketing/Sales; b,d,e

IM/D Corp.
Box 5238, 540 N. Commercial St., Manchester, NH 03101; Tel.: (603) 669-5224, Fax: (603) 669-3826; Frank Haigh, Director Marketing/Sales; a,b,c,d

IVEDCO Inc.
31441 Santa Margarita Pkwy A-166, Rancho Santa Margarita, CA 92688; Tel.: (714) 770-2635; Tom Fairfax, V.P.; b,e

Kurt Manufacturing Co., Electronics Div.
211 St. Anthony Blvd., NE, Minneapolis, MN 55418; Tel.: (612) 572-4415, Fax: (612) 789-7859; b,c,d

TYPE OF SERVICE

- a Design
- b Product assembly
- c Testing
- d Turnkey manufacturing
- e Cable and harness assembly

Micropolish
Z.I. des Pradeaux, 13850 Greasque, France; Tel.: (33) 42-699104, Fax: (33) 42-699470; Gerard Gilles, President/CEO; b

Mitech Electronics Corp.
411 Washington St., Otsego, MI 49078; Tel.: (616) 694-9471, Fax: (616) 692-2651; Kendall Meyer, Director Sales & Marketing; a,b,c,d,e

Qual-Pro Corp.
18101 Savarona Way, Carlson, CA 90746; Tel.: (213) 329-7535, Fax: (213) 399-0201; Gerald Shane, President; a,b,c,d,e

Quay Corp.
22 Meridian Rd., Eatontown, NJ 07724; Tel.: (201) 542-7340, Fax: (201) 389-1931; John Long, Director of Marketing; a,b,c,d,e

R&M Electronics
Box 1107, RD #5, Gibsonia, PA 15044; Tel.: (412) 443-8222, Fax: (412) 444-6833; Michael Hutchinson, President; a,b,c,d,e

Radio Television Products Corp.
2702 Washington Ave., North Douglas, AZ 85607; Tel.: (602) 364-4438, Fax: (602) 364-4430; W.J. McGaw, President; b,c,d

SeaFab Inc.
14648 N.E. 95th St., Redmond, WA 98052; Tel.: (206) 881-2778, Fax: (206) 882-0707; Bruce Murray, President; b,c,d

Sensor Scientific Inc.
6 Kings Bridge Rd., Fairfield, NJ 07004; Tel.: (201) 227-7790, Fax: (201) 227-8063; G. Robert Brimley, President; b,d,e

Silicon Valley Turnkey
544 Weddell Drive, #8, Sunnyvale, CA 94089; Tel.: (408) 745-1131; Marlene Rozett, President; a,b,c,d,e

A challenge to
the Electronics Industry
SHIP YOUR BIG STUFF NO OTHER WAY. . .

. . . because Panalpina has a special department to handle high-tech, sensitive equipment to and from anywhere in the world via air or ocean, including special charters.

We have the EDP software, the experience, the know how, full service support, and a qualified staff to match your service requirements.

We know we do it better. . . and we guarantee it!

PANALPINA

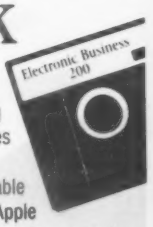
5 Continents – 1 Forwarder

Panalpina offices in 28 major U.S. cities and 185 cities overseas.

Panalpina, Inc.
34 Exchange Pl. Jersey City, NJ 07311 • (201) 915-1722/23

Panalpina, Inc.
18600 Lee Rd. Humble, TX 77338
(713) 446-0600

Electronic Business 200 On A Disk



The top 200 U.S. electronics and computer companies are ranked by electronics sales along with information on productivity, R&D, foreign sales and other financial data.

This year's **Electronic Business 200** is now available on disk (IBM-compatible Lotus 1-2-3 format or Apple Macintosh Excel versions for $100. Results for any three years (1986, '87, '88, '89) may be purchased for $200. To order, please send a check payable to *Electronic Business* and the order form to:

Electronic Business, Jean O' Brien, 275 Washington Street, Newton, MA 02158 Tel: (617) 558-4257

☐ Yes, I would like to receive a copy of the **Electronic Business 200** on a disk.

Format: ☐ IBM-compatible Lotus 1-2-3 ☐ Apple Macintosh Excel

☐ 1 year ($100) ☐ 3 years ($200 — circle choices: 1986, '87, '88, '89)

A check for $_____ is enclosed.

Name _____

Address _____

City _____ State _____ Zip _____

Send to: Electronic Business, Jean O'Brien, 275 Washington St., Newton, MA 02158

CONTRACT MANUFACTURING

Synesis Corp.
2307 Bering Drive, San Jose, CA 95131; Tel.: (408) 435-1283, Fax: (408) 435-0555; a,b,c,d

SYNTEC Corp.
2201 Donley Dr., Austin, TX 78758; Tel.: (512) 835-4295, Fax: (512) 835-0469; Donald Brewer, Engineering Manager; b,c,d,e

Test Group Inc.
10225 Barnes Canyon Rd., S-109, San Diego, CA 92121; Tel.: (619) 450-1722, Fax: (619) 450-9639; Joe Hypnarowski, Marketing Manager; b,c

Tii Industries Inc., CAMI Div.
P.O. Box 433, Toa Alta, Puerto Rico 00758, Tel.: (809) 870-2700, Fax: (809) 870-2512; Alan Hotaling, V.P. & General Manager; b,c,e

Time Mark Corp.
11440 East Pine St., Tulsa, OK 74116; Tel.: (918) 438-1220, Fax: (918) 437-7584; Steve Purple, National Sales Manager; a, b,c,e

Trionics Inc.
704 East North St., Elburn, IL 60119; Tel.: (708) 365-6570, Fax: (708) 365-6575; James Teppo, President; a,b,c,d,e

VerTek International Inc.
6775 Custom House Plaza, Suite D, San Diego, CA 92073; Tel.: (619) 661-6868, Fax: (619) 661-1229; John Riley, V.P. Operations; b,e,e

Less than $1 million

Argo Electronics Inc.
5054 Bleecker St., Baldwin Park, CA 91706; Tel.: (818) 962-8422, Fax: (818) 960-7312; Gerd Gleim, V.P. b,d,e

Branmag Inc.
908 Niagara Falls Blvd., North Tonawanda, NY 14120; Tel.: (716) 693-5994, Fax: (716) 856-4802; Branko Veljkovic, President; a,b,c,d,e

TYPE OF SERVICE

a Design
b Product assembly
c Testing
d Turnkey manufacturing
e Cable and harness assembly

Cable Concepts Inc.
28 San Sebastian Way, Sandwich MA 02563; Tel.: (508) 888-1951, Fax: (508) 833-1608; Judy Cash, Sales Manager; b,c,d,e

CAD Engineering & Assembly Inc.
8663 Tyler Blvd., Mentor, OH 44060; Tel.: (216) 255-7744, Fax: (216) 255-5900; Frank Novak, President; a,b,c,d,e

D&P Manufacturing Inc.
32 Hamilton St., PO Box 107, Chalfont, PA 18914; Tel.: (215) 997-1200; Gunther Diefes, President; a,b,c,d

E.C.M. Inc.
1515 West 259 St., Harbor City, CA 90710; Tel.: (213) 530-3456, Fax: (213) 530-9161; Wes Kirchoff, President; a,b,e

Edbeth Enterprises
South Park Plaza Spur 239, Del Rio, TX 78840; Tel.: (512) 774-4672; Ann Snyder, Manager, a,b,c,d

Light Systems Inc.
1305 Irma Rd., Warminster, PA 18974; Tel.: (215) 675-4811; Harry Moffat, President; b,e

MANU-TEC Inc.
415 West Belden Ave., Addison, IL 60101;Tel.: (708) 543-3022, Fax: (708) 543-7766; Richard Zboril, President; a,b,c,d,e

PC Express Inc.
15103 US Highway 19, Hudson FL 34667; Tel.: (813) 863-6114; Charles Lent, President; a,b,c,d

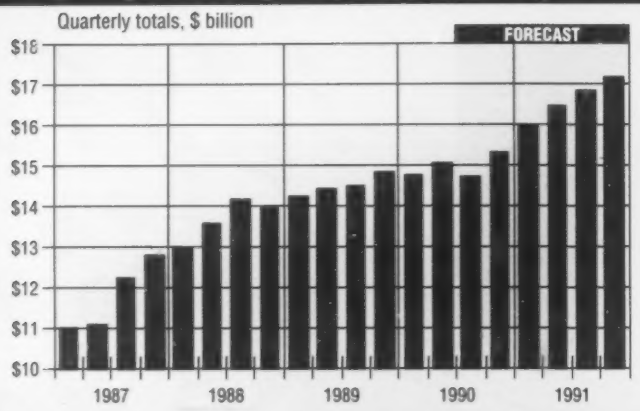
Rel-Tech Electronics Inc.
955 Connecticut Ave., Bridgeport, CT 06607; Tel: (203) 333-8190, Fax: (203) 332-0417; W.D. LeBlanc, Jr., V.P.; e

Southtronics Inc.
1265 Kennestone Circle, Marietta, GA 30066; Tel.: (404) 429-1000, Fax: (404) 424-2000; Randy Staton, Marketing Director; a,b,c,d

What people think about your company may have more to do with your success in the marketplace than anything else.

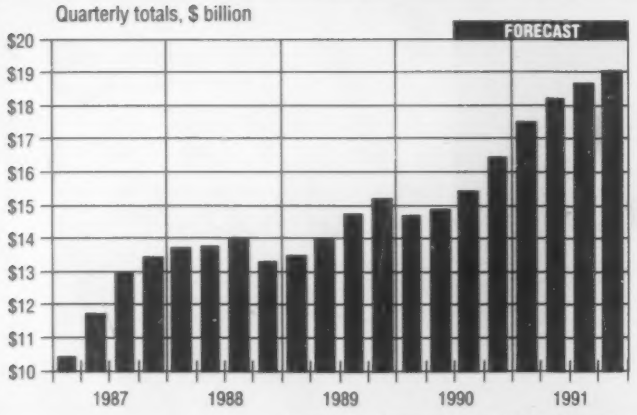
Electronic Business

U.S. component shipments to post solid gains...



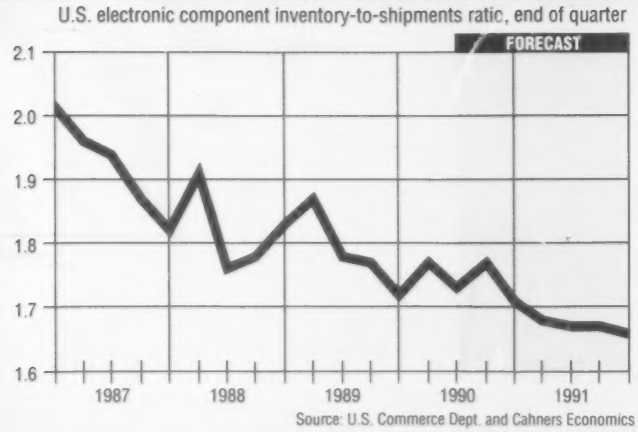
Source: U.S. Commerce Dept. and Cahners Economics

...so will new orders



Source: U.S. Commerce Dept. and Cahners Economics

...as inventories are kept under control



Source: U.S. Commerce Dept. and Cahners Economics

Upturn expected for electronic components

U.S. electronic component factories started to see strong signs in the second quarter of 1990 that their industry may be ending months of slow growth. Improvements in shipments, orders, backlogs and inventories lead Cahners Economics to forecast an electronic components upturn for the rest of this year and next.

Three months ago, Cahners Economics predicted shipments of electronic components would decline 0.1% in the second quarter of this year. However, shipments of resistors, semiconductors, printed circuit boards, capacitors, connectors and other devices actually broke the $15 billion mark, rising 4.4% above year-ago levels, according to the Commerce Department. This is the highest quarterly dollar value of shipments ever seen.

New orders of U.S. electronic components also exhibited stronger-than-expected second-quarter gains. Orders swelled 6.2% in the second quarter of 1990 compared with orders for the same quarter last year, rebounding from the meager 1.7% second-quarter growth seen from 1988 to 1989. Optimistic signs, such as stronger end-market demand from the computer industry, should translate into an increase in new orders though 1991.

Two other signals for the components industry are encouraging:

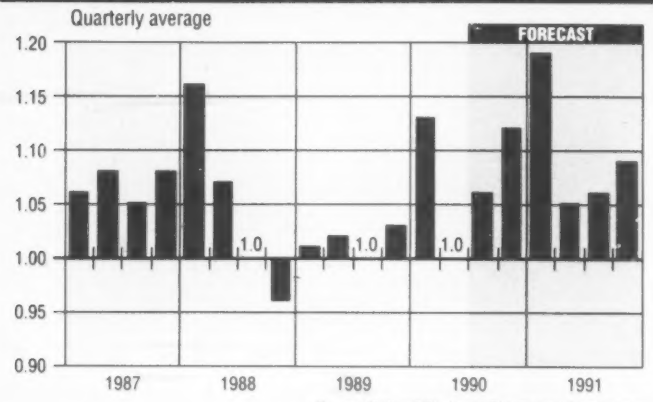
- Unfilled orders definitely turned the business cycle corner, growing 3.5% in the second quarter of this year to $14.1 billion. The last time back orders saw positive growth was in the final quarter of 1988.
- Inventories remained low too, with the component inventory-to-shipments ratio averaging 1.73 in the second quarter of this year, down from 1.78 in the second quarter of 1989.

In short, chip makers no longer need to worry about an industry slowdown. It appears as if the components industry passed its low point and is headed back up. Cahners Economics expects U.S. factory shipments of electronic components to inch up 2% in 1990 and a whopping 12.2% in 1991. Likewise, new orders are predicted to rise 5.9% this year and skyrocket 20.7% in 1991.

JULIE HANDELMAN

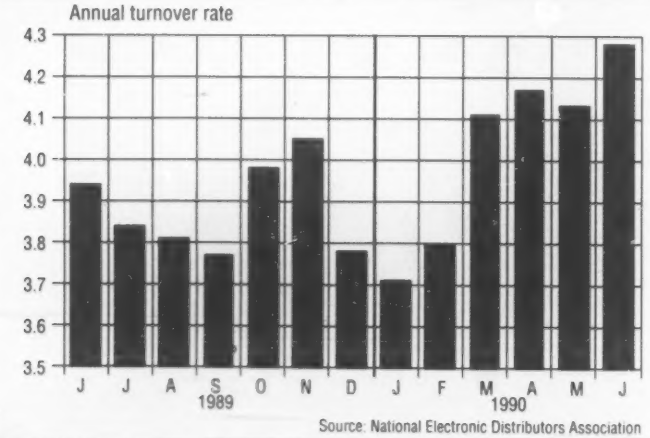
For more information about Cahners Economics' forecasting services, including seminars, newsletters and databases, contact Dan Buchan at 617-630-2105 or 617-964-3030, by fax at 617-630-2100 or write Cahners Economics, 275 Washington Street, Newton, MA 02158-1630, USA.

Electronic distributors book-to-bill ratio



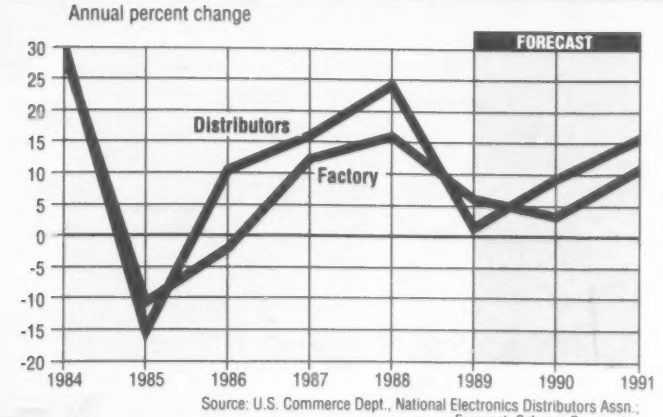
Source: National Electronic Distributors Association; Forecast: Cahners Economics

Distributors inventory turnover



Source: National Electronic Distributors Association

Component shipments: factory vs. distributors



Source: U.S. Commerce Dept., National Electronics Distributors Assn.; Forecast: Cahners Economics

Distributor orders slow, but optimism persists

After a burst in orders last spring, the nation's largest distributors report orders grew just 10.7% from year-ago levels in the three months ending June 30. That's nearly 10% below the growth rate from the first quarter of 1989 to the first quarter of 1990. Does this slowdown in orders mean the bubble has burst for distributors?

The answer is no. Distributors' orders growth may have softened and the book-to-bill ratio may have tumbled to 0.95 for the quarter ending in June, but the underlying upward trend in distribution remains unchanged. The more reliable statistic in tracking electronic distributors is shipments. The shipments trend remains healthy and on-target with a general electronics industry rebound still anticipated to take place in the second half of 1990.

Three months ago, we predicted in this column that distributors' shipments would grow 10.4% in the second quarter of 1990 over year-ago levels. Shipments actually saw a 13% gain, somewhat stronger than anticipated. Because the forecast and actual second-quarter performance were close, Cahners Economics' distributors' shipments growth forecast remains unchanged. We continue to expect 9.2% annualized growth in 1990 and a 15.8% gain in 1991.

Given all the jittery forecasters and low business-confidence levels that prevail at press time, this forecast places the ELECTRONIC BUSINESS economists in the category of optimists. We feel our optimism is well founded. Distributors'-shipments growth roughly precedes growth in electronic component shipments. With interest rates expected to fall and computer orders firming, a 12.2% gain in factory shipments of components in 1991 is not at all unlikely. With distributors' reactions more volatile, and with inventory turnover high, the 1990 distributors' shipments growth forecast appears entirely reasonable.

Of course, beware the ever-present economist's caveat: All our forecasts bar any unforeseeable, usually politically induced, shock to the economic system. What impact rising oil prices will have on distributors and the entire economy as Iraq's aggression in Kuwait drives up oil futures remains to be seen. For now, the impact on distribution growth appears to be negligible.

ELIZABETH B. BAATZ